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(54) RECEIVED SIGNAL STRENGTH DETERMINATION METHODS AND SYSTEMS

EMPFANGSSIGNALSTÄRKE BESTIMMUNGSMETHODEN UND SYSTEMEN

PROCEDES ET SYSTEMES DE DETERMINATION DE L'INTENSITE DES SIGNAUX RE US

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Description

Field of the Invention

[0001] The invention relates to communication networks and, more particularly, to the determination of received signal strength in communication networks.

Background of the Invention

[0002] Communication networks typically include at least one sender and one receiver. In either a wired or wireless network, a signal transmitted between the sender and receiver must be of sufficient magnitude (or strength) to allow the information contained within the signal to be discriminated from the noise which is generally present in the communication network. This may be a greater problem with a wireless network, which typically is more susceptible to noise from various interference sources.

[0003] An example of a wireless network is a radio network such as a cellular network commonly utilized for voice and/or data communications between a fixed base station covering a geographic region and mobile devices such as cellular terminals (or phones) present in the covered region. A cellular phone typically includes a radio receiver including an antenna for receiving signals and an amplifier/detector for generating a measure of the strength of received signals or noise. A signal strength measure, commonly known as Radio Signal Strength Indication (RSSI), may be expressed as a logarithmic measure of received signal strength and may be converted to a digital form by an analog to digital converter.

[0004] It is known in the prior art that radio signal strength measurements can be useful in determining which base station should serve a cellular phone during a call. In the U.S. AMPS system, the mobile phone would typically use such signal strength measurements to determine the strongest base station to which it should listen for calls during standby (idle) mode. Also in the U.S. AMPS system, base stations belonging to the cellular network typically listen to the signal strengths received from mobile phones that are actively transmitting during calls, and the network uses its measurements to determine an optimum base station for handling a call in progress. When a call in progress is switched from one base station to another, it is commonly known as "handover" or "handoff." Handoffs enable calls to be maintained even though the mobile phone may be changing location.

[0005] Cellular phones using a Time Division Multiple Access method conforming to either the European cellular standard known as GSM or any of the American TDMA standards, for example, those known respectively as D-AMPS, IS54, IS136 or PCS1900, may use spare time between transmit and receive timeslots to change frequency and monitor the signal strengths of other base stations. Several measurements of signal strength may be averaged for the same base station. The mobile phone makes measurements of the signal strengths received from surrounding base stations even during the progress of a call. Mobile Assisted Handover (MAHO) may be implemented using these measurements. The averages are typically reported to the currently serving base station, which determines if a handoff should be made to another, base station. The mobile typically reports MAHO RSSI measurements to the network station using a low-bitrate, inband signaling channel called the Slow Associated Control Channel or SACCH. The network uses SACCH measurements to determine the optimum base station to handle a call in progress, preferably the base station that the mobile phone is receiving most strongly.

[0006] In order for MAHO to operate effectively, it is preferred that the RSSI measurements that are reported to the network using the SACCH are reasonably accurate over a wide range of signal strengths that may be encountered from base stations. It is known in the prior art to employ logarithmic IF amplifiers with progressive saturation and progressive detectors in order to produce an RSSI signal approximately proportional to the logarithm of the received signal strength. See for example U.S. patents Nos. 5,048,059 entitled "Logpolar Signal Processing" and 5,070,303 entitled "Logarithmic Amplifier/Detector Delay Compensation" which are incorporated by referenced herein in their entirety.

[0007] Inaccuracy in RSSI measurements may occur when the RSSI value is not exactly proportional to (linearly related to) the received signal strength. Inaccuracy of RSSI measurements may also occur when measuring strong signals that partially saturate amplifying stages prior to the RSSI detectors; a 10dB increase in received signal level may not then be passed through to the RSSI detectors due to the preceding amplifiers being unable to deliver a 10dB increase in output signal. The RSSI detectors typically then register a lower increase in signal strength than is actually received. One approach to extending the range of measurements for an RSSI detector is described in European Patent Application EP0785640A1 entitled "Method for extending the RSSI range and radio transceiver operating in accordance with this method" in which an additional, selectable attenuation is included in the measurement circuit. More particularly, an attenuation in each of two states of a selectable component in the receive path which is already present for some other function is determined and optionally selected. Nonetheless, inaccuracies may still result based on variations between mobile phones or changes with temperature or other conditions that vary in operation. Therefore, there is a need for an improved means to account for such inaccuracies.

Summary of the Invention

[0008] It is, therefore, an object of the present invention to provide improved and more accurate methods and systems for calculating a received signal strength indication.

[0009] It is a further object of the present invention to provide methods and systems which calculate a received signal strength indication which is compensated for non-linearity in the received signal which might otherwise cause the calculated signal strength measurement to not accurately represent the actual signal strength.

[0010] These objects are provided according to the present invention by taking first and second signal strength readings with the receiver set at first and second known gain levels, respectively. The signal strength measurement may then be compensated based on the two measurements. In particular, the difference between the expected change in the signal strength and the change actually measured by the receiver may be used, according to an embodiment of the present invention, to generate a compensated signal strength measurement.

[0011] According to one embodiment of the present invention, the compensated signal strength measurement is compensated for non-linear characteristics of the receiver. In a further embodiment of the present invention the second gain level is less than the first gain level. The methods of the present invention are particularly beneficial where the first and second signal strength measurements are logarithmic RSSI signals.

[0012] In a further aspect of the present invention, before obtaining a first signal strength measurement, an expected strength of a next signal strength measurement of the received signal is determined. If the expected signal strength is less than a predetermined criteria, i.e., if no compensation is expected to be needed, the second signal strength measurement of the received signal is not obtained and the compensated signal strength measurement is the first signal strength.

[0013] In another embodiment of the methods of the present invention, operations for generating a compensated signal strength measurement include determining an expected difference between the first signal strength measurement and the second signal strength measurement based on the first gain level and the second gain level. The actual difference between the first signal strength measurement and the second signal strength measurement is then generated. The actual difference is compared to the expected difference to provide a signal strength compensating factor. The compensated signal strength measurement is generated based on the signal strength compensating factor. The compensated signal strength measurement may be generated by summing the signal strength compensating factor and the first signal strength measurement to provide the compensated signal strength measurement. Alternatively, a previously determined compensation factor associated with the second signal strength measurement may be obtained from a memory means. The signal strength compensating factor, the previously determined compensation factor associated with the second signal strength measurement and the first signal strength measurement are then summed to provide the compensated signal strength measurement.

[0014] In a further aspect of the present invention, the compensated signal strength measurement is transmitted to the network for use in mobile assisted handover. Alternatively, the compensated signal strength measurement may be averaged with an earlier compensated signal strength measurement to provide an averaged signal strength measurement for transmission to the network.

[0015] In another aspect of the present invention, a table of compensation factors may be dynamically maintained. According to this aspect of the methods of the present invention, a previously determined compensation factor associated with the second signal strength measurement is obtained. The previously determined compensation factor associated with the second signal strength measurement is adjusted based on the calculated signal strength compensating factor to provide an updated compensation factor associated with the second signal strength measurement.

[0016] A system for measuring a strength of a received signal is also provided according to the present invention. The system includes a receiver capable of operating at a first gain and a second gain. Also included is a received signal strength indication generating circuit electrically connected to the receiver which provides a signal strength indication corresponding to a strength of a signal received by the receiver. A compensated signal strength measurement generating circuit which characterizes the strength of the received signal based on a first signal strength measurement at the first gain and a second signal strength measurement at the second gain is operatively connected to the received signal strength indication generating circuit. In one embodiment of the systems of the present invention, the system further includes means for causing the receiver to operate at one of the first gain or the second gain.

[0017] While the present invention has been summarized above primarily with respect to the methods of the present invention, it is to be understood that the present invention is also directed to systems for carrying out the operations described above with respect to the method aspects of the present invention as will be described more fully herein.

[0018] The present invention is particularly beneficial when the received signal is a signal received over a communications medium at a receiver station from a sender station. More particularly, the present invention is beneficial for use where the communications medium is a wireless communications medium such as a cellular system which utilizes mobile assisted handover, as

more accurate data may be reported from the mobile to the cellular system on the relative strength of the signal from various available base stations.

Brief Description of the Drawings

[0019]

FIG. 1 is a block diagram illustrating a signal receiver apparatus according to an embodiment of the present invention.
FIG. 2 is a graphical illustration of non-linear signal strength detection characteristics.
FIG. 3 is a flowchart illustrating operations according to an embodiment of the present invention.
FIG. 4 is a flowchart illustrating operations according to an embodiment of the present invention.

Detailed Description of Illustrated Embodiments

[0020] The present invention now will be described more fully hereinafter with reference to accompanying drawings, in which preferred embodiments of the invention are shown. This invention may, however, be embodied in many different forms and should not be construed as limited to the embodiments set forth herein; rather, these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the scope of the invention to those skilled in the art.

[0021] Referring now to **FIG. 1,** an embodiment of a single receiver apparatus **10** according to the present invention will now be described. **FIG. 1** illustrates a receiver circuit block diagram for a wireless device such a mobile phone. Receiver **10** includes an antenna **12** or other means for receiving signals over a communications medium. While it is to be understood that the present invention may be applied to signals over wired communication links, the benefits of the present invention are particularly applicable in wireless communications environments such as radio frequency transmissions over air and cellular telephone communication networks.

[0022] Signals received by antenna **12** are processed through transmit/receive duplexer **14.** Duplexer **14** provides a switchable connection between antenna **12** and receive circuit **16** and transmit circuit **18.** A receive signal is routed by duplexer **14** to dual band front end circuit **20.** This signal is provided to front end amplifier **22.** In the illustrated embodiment of **FIG. 1**, duplexer **14** may be a duplexing filter for simultaneous transmit and receive in an AMPS mode or, alternatively, a transmit/receive switch for operating in a time-duplex mode such as the D-AMPS mode, or, in a dual-band telephone, may comprise a duplexing filter at 800 MHz (the AMPS band) and a transmit/receive switch at 1900 MHz (the PCS band) in which only the D-AMPS time-duplex mode is used. In a dual-band telephone operating at both 800 MHz and 1900 MHz, the front-end radio frequency amplifier **22** and first super heterodyne downconverter **23** comprise circuits adapted to both frequency bands, with means to select the operating frequency band under control of the control processor **24**.

[0023] As illustrated in **FIG. 1,** the down conversion takes place in dual-band front end circuit **20** for with processor **24** providing band selecting control information to front end circuit **20.** Received signals are down converted in front end circuit **20** to a suitable first intermediate frequency (first IF). The signal is then filtered using first IF filter **26.** This signal is down converted once more in second mixer circuit **30** to a second IF. Further filtering and amplification takes place at second IF filter **32** and amplifier **34** to yield a hard limited second IF signal from which amplitude modulation has been removed in addition to an RSSI signal approximately proportional to the logarithm of the receive signal strength containing the removed amplitude information. The hard limited second IF signal containing phase information plus the RSSI signal containing amplitude information are passed to the receive/transmit signal processor circuit **36** where they are processed, for example, using the method of United States Patent No. 5,048,059 which has been previously incorporated herein by reference.

[0024] Receive signal processing by receive/transmit processing circuit **36** includes, among other things, analog to digital conversion of the RSSI signal. The digitized RSSI value is provided to control processor **24** for use in constructing a SACCH message to report received signal strength to the communication network for mobile assisted handover (MAHO) purposes.

[0025] Transmit signal processing by circuit **36** converts SACCH messages of voice or user data signals such as FAX signals to I, Q modulation for modulating the transmitter using I, Q modulator circuit **40.** I, Q modulator circuit **40,** as illustrated in **FIG. 1,** is part of dual-band circuit **18** which provides for a transmit carrier frequency which is separated from the selected receive frequency by a specified amount typically referred to as the duplexing spacing. Duplex spacing is typically 45 MHz for 800 MHz band operation arid 8.04 MHz for 1800 MHz band operation according to the D-AMP standard IS 136. While additional details of receiver **10** are illustrated in the embodiment of **FIG. 1,** they will not be discussed further herein as they are not required to understand the benefits and operations of the present invention and further as they are known to those of ordinary skill in the art.

[0026] Control processor **24,** in addition to providing means for controlling the band select of front end circuit **20,** further includes means for controlling whether first RF amplifier **22,** located in front end circuit **20** prior to the first down converter, operates at a first, full gain or a second, reduced gain. According to one embodiment of the present invention, a reduced gain in the order of 20 dB is obtained by switching off the RF amplifier **22** current or, alternatively, by reducing its current under the control of a control signal from the control processor **24.**

The control processor **24** further provides means to detect when RSSI measurement values fall in a region where non-linearity of the RSSI detector characteristic or compression in the first RF amplifier **22** or second down converter **30** may reduce the measurement accuracy. This would normally only occur for strong signals that can be successfully received even with a 20 dB gain reduction in RF amplifier **22.** Consequently, the control processor **24,** upon detecting RSSI measurements of sufficient magnitude to be in the range or distortion could be introduced, causes a controlled reduction in the gain of RF amplifier **22** and then initiates a second RSSI measurement with the gain reduced.

[0027] The difference in the RSSI measurements with and without the gain reduction should correspond to the controlled gain reduction itself, assuming linearity. Therefore, if the gain reduction measured does not correspond to the controlled or expected gain reduction, this is indicative of a non-linearity in the RSSI detection characteristics of receiver **10**. The difference in RSSI values less the expected difference corresponding to the selected gain reduction is then indicative of the amount of non-linearity and may be used, according to the present invention, by control processor **24** to compute a corrected RSSI value which has been compensated for this non-linearity. The corrected RSSI values are then used for reporting MAHO measurements to the network using the SACCH. Corrected RSSI values may also, optionally, be used for improved logpolar signal processing.

[0028] Operations for an embodiment of the present invention for a particular non-linear received signal will now be explained more fully with reference to **FIG. 2. FIG. 2** shows a non-linear RSSI detection characteristic caused by compression of amplifier stages prior to the detectors which may, typically, be encountered at high signal levels. As illustrated in **FIG. 2,** when the RF amplifier gain is reduced by, for example, 20 dB, the RSSI change actually measured will likewise be 20 dB at small signal levels. This is illustrated by the region of **FIG. 2** below -70 dBm on the X axis where the actual detected signal strength, as illustrated by the solid line, substantially tracks the linear approximation illustrated by the dotted line.

[0029] The illustrated example of **FIG. 2** reflects the RSSI measurement value on the Y axis showing a range of zero to 240 approximating the value range which would typically be encountered for an 8-bit analog to digital conversion of an RSSI signal for processing by control processor **24.** For purposes of the illustrated embodiments of the present invention, such an 8-bit analog to digital conversion will be assumed although it is to be understood that the benefits of the present invention may be obtained with other resolutions and are not limited to 8-bit analog to digital converters.

[0030] As is further illustrated in the example of **FIG. 2,** at progressively higher signal levels, the measured values of the solid line deviate from the linear approximation. The amount by which the RSSI changes, as illustrated, is less than 20 dB, indicating the amount of compression taking place over a 20 dB range of signal level. This can be best understood with reference to points A and B on **FIG. 2**. As illustrated in **FIG. 2,** the actual received signal level for point A is -50 dBm. The RSSI measurement is made with an 8-bit AtoD converter yielding an energy value between zero and 255 with the least significant bit (at small signal levels) of 0.5 dB per bit and the zero to 255 energy range corresponds nominally to the signal level range -127.5 dBm to 0 dBm. For this arrangement, the expected reading based on the nominally linear RSSI detection curve for a signal level of -50 dBm is, therefore, 155. In general, the expected reading for a signal level of X dBm is given by the formula 255 -2X. As can be seen by the readings at point A of **FIG. 2,** however, the actual reading at -50 dBm is not 155, but is instead 151. This indicates an error of 4 counts or, approximately, 2 dB (at 0.5 dB per bit). The apparent signal level is therefore, detected at -52 dBm as compared with the true value of -50 dBm.

[0031] According to the methods and systems of the present invention, a second set of readings is taken at point B to provide information for use in compensating the RSSI measurement. Control processor **24** reduces the gain of front end amplifier **22** by a controlled amount, for example, 20 dB as illustrated in **FIG. 2**. Therefore, the actual signal level passed through to the RSSI detectors at point B is expected to be -70 dBm, i.e., 20 dB lower than the previous -50 dBm. An RSSI reading is taken again at point B with the expected reading as 115. However, as can be seen from **FIG. 2,** some non-linearity is still present and the actual reading obtained with the 20 dB program gain reduction is not 115, but instead is 114. This reflects an error of 0.5 dB at the -70 dBm signal level.

[0032] The change in the signal readings from 151 to 114, a decrease of 37, compares with the expected change of reading of 40 bits based on 0.5 dB per least significant bit (LSB). This indicates that the compression at a reading of 151 is 3 units (or bits) more than the compression at a reading of 114. The control processor **24**, according to the illustrated embodiment of the present invention, therefore adds a compensating amount of 3 units to the reading of 151. Further accuracy may be provided by also adding to the RSSI reading a compensating amount previously determined and stored for the reading of 114. For example, assuming that a similar RSSI compensating measurement sequence had previously taken place and determined a compensating amount of one unit per reading of 114, then the reading of 151 illustrated in **FIG. 2** would be compensated by adding three units plus an additional one unit to obtain a compensated RSSI value of 155. This would compensate the RSSI value and set it equal to the expected value, thereby correcting the 2 dB error in the reading and providing a more accurate value for the signal strength measurement.

[0033] In the illustrated embodiment, control processor **24** may also estimate the compensation factor to be added at other signal strengths between -70 dBm and -50 dBm by assuming that the 3 units of compression over this 20 dB range would be proportionally less over a smaller range. For example, at -60 dBm, the control processor **24** would anticipate 1.5 units of compression, as -60 dBm is halfway between -70 and -50 dBm, therefore half the number of units of compression is anticipated for a linear model. This is added to the amount of compression already estimated on a previous occasion for -70 dBm (assumed to be 1 unit above) to obtain a total of 2.5 units for -60 dBm. In this way, the control processor **24** may compute the expected compression for every signal level (RSSI reading) over the range -50 dBm to -70 dBm (corresponding to uncorrected RSSI readings of 114 to 151) and store them in a memory means such as a look-up table in Electrically Erasable and Reprogrammable Memory (EEPROM) or other, preferably non-volatile, storage means. By repeating the procedure on other occasions while receiving other signal strengths, the table may be filled with learned correction values for each reading level (0-255).

[0034] Once the table is filled, future computations will result in new values of compensation for a signal level reading that may or may not be identical to a previously estimated value. When this occurs, the new estimated values can be substituted or alternatively averaged with the previous values. For example, the previous value can be adjusted a fraction of the way towards the new value, for example, $1/16^{th}$ or other reciprocal power of two may be chosen to facilitate division by a right-shift of the difference between the old and new values in simple microprocessors.

[0035] As will be appreciated by those of skill in the art, the above described aspects of the present invention in **FIGS. 1,** and **2** may be provided by hardware, software, or a combination of the above. While the various components of the systems of the present invention have been illustrated in part as discrete elements in **FIG. 1,** they may, in practice, be implemented by a microcontroller including input and output ports and running software code, by custom or hybrid chips, by discrete components or by a combination of the above.

[0036] **FIG. 3** shows a flow chart further illustrating operations of an embodiment of the present invention. At block **100,** a first signal strength measurement of the received signal is obtained with receiver **10** set at a first gain level. A second signal strength measurement of the received signal is obtained with receiver **10** set at a second gain level at block **102.** At block **104,** the expected difference between the first signal strength measurement and the second signal strength measurement is determined based on the first gain level and the second gain level. For example, if the gain level is dropped by 20 dB, the expected difference between the two readings would be 20 dB. The actual difference between the first signal strength measurement and the second signal strength measurement is also generated at block **104** by subtracting the two measurement values.

[0037] At block **106,** a previously determined compensation factor associated with the second signal strength measurement is obtained, preferably from a memory storage means operatively associated with receiver **10.** Also at block **106,** the actual difference is compared to the expected difference to provide a signal strength compensating factor. A compensated signal strength measurement is generated at block **108** based on the signal strength compensating factor and the previously determined compensation factor associated with the second signal strength measurement. The compensated signal strength measurement, in one embodiment of the present invention, is generated by summing the signal strength compensating factor, the previously determined compensation factor associated with the second signal strength measurement and the first signal strength measurement. The compensated signal strength measurement is transmitted to the communication network for use in mobile assisted handover at block **110.**

[0038] The above-described procedure functions both for RSSI curves that give too low a reading and for RSSI curves that sometimes yield too high a reading, that is for both concave and convex curves as well as S-shaped curves. Optionally, an initial table of compensation values can be determined in the factory during production testing and programmed into the EPROM or EEPROM of the receiver **10.** Subsequently, after delivery to a customer, the table can be read from such memory into Random Access Memory (RAM) for updating based on RSSI measurements made during further use. Values updated in RAM may be rewritten to EEPROM if it is desired to remember the updated values for future use. Alternatively, the factory-programmed values may be recalled every time receiver **10** is switched on and updated values produced only for that period of use.

[0039] In a TDMA system such as the GSM/PCS1900 system or in the DAMPS/IS54/IS136 system, spare time between transmit and receive timeslots is used by the mobile phone receiver **10** during active conversation to make RSSI measurements on other base station's signals. The network will generally previously have downloaded to the mobile phone a list of the channel numbers of surrounding base stations on which measurements should be made. In GSM, roughly 220 measurements per second are typically made and in D-AMPS 50 measurements are made on typically 6 surrounding base stations. Thus, repeat measurements on the same base station are typically made several times per second and may, optionally, be averaged over a moving time window to obtain a moving average signal strength for each base station in the list. According to one aspect of the present invention, the moving average may be based on compensated RSSI values.

[0040] The moving average may also be used to predict the signal level that the next measurement of a pre-

viously measured base station will produce. If the predicted signal level is in a range where significant compression or other significant departure from a linear RSSI curve is expected (or has previously been determined according to the methods of the present invention as described above), particularly at high signal levels, then the control processor **24** responds by starting the new measurement on that base station with reduced gain at RF amplifier **22.**

[0041] In one embodiment of the method aspects of the present invention, successive measurements are made when the moving average signal level is in such a range. This procedure has further benefits that false RSSI readings due to receiver imperfections such as intermodulation and blocking may be detected and eliminated so that they do not result in false handovers. For example, a false reading caused by 3rd order intermodulation between two strong signals appearing as a third signal on a measurement channel will give a much stronger reading with full gain than with 20 dB reduced gain - but only on that particular frequency. If its has previously been determined that such an RSSI curve anomaly does not occur at another channel frequency, the anomaly may be recognized as a frequency anomaly rather than an RSSI curve anomaly and the measurement value at full gain may be discarded. The measurement at reduced gain may then be used, suitably compensated for the compensation factor at the reduced signal level (if any), and compensated by the amount of gain reduction. In this way, the inventive method may also protect against false handovers to base stations that only appear to be received strongly due to an intermodulation phenomenon.

[0042] Referring now to the flowchart of **FIG. 4,** operations according to a further aspect of the present invention will now be described. At block **200,** control processor **24** selects the next frequency from the MAHO list on which a measurement of single strength is to be made. For a TDMA type communication network, control processor **24** further waits for the scan time slot dedicated to monitoring transmissions from various available base stations. At block **204,** control processor **24** determines if the expected signal strength, as indicated by a current moving average value associated with this selected frequency, exceeds a predetermined limit (i.e., lies in a region where measurement error may be expected). If the expected signal strength indicates potential error at block **204,** operations proceed at block **206** to determine if a previous measurement was taken for the selected MAHO frequency. At block **208,** if a previous measurement was made, operations continue by checking whether the previous measurement was made at reduced gain. If the previous measurement was made with reduced gain, the new measurement will be made with full gain by selecting full gain at block **210.** Otherwise, reduce gain is selected at block **212.** Reduced gain is also selected if, at block **206,** it is determined that no previous measurement was made. In other words, if an expected signal strength is in the error region, the first reading is taken with reduced gain rather than full gain. If the expected signal strength does not indicate potential error at block **204,** full gain is selected at block **210.** Operations at blocks **206** and **208** provide for alternating measurements will full and reduced gain. Note that while not illustrated in **FIG. 3,** if there is no previous reading, i.e., if the reading is for the first time on a new MAHO frequency channel (meaning there is no basis on which to establish a moving, average value for that channel), the initial measurement will be made with reduced gain. If the initial or first measurement indicates a low signal strength, then the second measurement on that same channel will be made with full gain (block **210**) based upon the test at block **204.**

[0043] Having selected either full or reduced gain for a new measurement, control processor **24** takes the measurement at block **214** with the selected gain. A new measurement is processed together with previous measurements, if they were made with different gain values, to determine updated compensation values using the above-described methods according to the present invention (block **216**). At block **218,** the most recent measurement is compensated using the appropriate one of the updated compensation values. The compensated measurement is then used at block **220** to update the moving average signal strength for the updated MAHO frequency channel before returning to block **200** to select the next MAHO frequency channel.

[0044] For simplicity in illustration, **FIG. 4** omits various of the details of operations according to preferred embodiments of the present invention. For example, the steps of storing new and previous measurements and of storing, for each MAHO frequency channel, a memory of whether the previous measurement was made with full or reduced gain or whether no previous measurement exists are not expressly shown in **FIG. 4** although they have been described herein. These steps are preferably included in a practical implementation of systems and methods according to the present invention.

[0045] To a first order approximation, the compression was assumed in the above discussion to onset in a linear manner providing that the compression in dB would be half the amount for a signal 10 dB lower than the measured level as compared with a signal 20 dB lower. The amount of compensation to be used at intermediate levels within the 20 dB band was determined using the linear first order approximation. However, it is to be understood that other models of compression may be utilized with the present invention based, for example, on higher order polynomials rather than a straight line or linear assumption, to provide for increased accuracy of measurements of the RSSI characteristics for the intervening values.

[0046] The present invention has been described above with respect to **FIGS. 3** and **4** with reference to flowcharts illustrating the operation of the present invention. It will be understood that each block of the flowchart

illustrations, and combinations of blocks in the flowchart illustrations, can be implemented by computer program instructions. These program instructions may be provided to a processor to produce a machine, such that the instructions which execute on the processor create means for implementing the functions specified in the flowchart block or blocks. The computer program instructions may be executed by a processor to cause a series of operational steps to be performed by the processor to produce a computer implemented process such that the instructions which execute on the processor provide steps for implementing the functions specified in the flowchart block or blocks.

[0047] Accordingly, blocks of the flowchart illustrations support combinations of means for performing the specified functions, combinations of steps for performing the specified functions and program instruction means for performing the specified functions. It will also be understood that each block of the flowchart illustration, and combinations of blocks in the flowchart illustration, can be implemented by special purpose hardware-based systems which perform the specified functions or steps, or combinations of special purpose hardware and computer instructions.

[0048] In the drawings and specification, there have been disclosed typical preferred embodiments of the invention and, although specific terms are employed, they are used in a generic and descriptive sense only and not for purposes of limitation, the scope of the invention being set forth in the following claims.

Claims

1. A method for measuring a strength of a received signal including the steps of obtaining a first signal strength measurement of the received signal from a receiver and obtaining a second signal strength measurement of the received signal from the receiver wherein

   the receiver (10) is set at a first gain level to obtain the first signal strength measurement and is set at a second gain level to obtain the second signal strength measurement **characterized by** further comprising the steps of:

   determining an expected difference between the first signal strength measurement and the second signal strength measurement based on the first gain level and the second gain level;
   generating the actual difference between the first signal strength measurement and the second signal strength measurement:

   comparing the actual difference to the expected difference to provide a signal strength compensating factor; and
   generating a compensated signal strength measurement of the received signal based on the signal strength compensating factor.

2. A method according to Claim 1 wherein the compensated signal strength measurement is compensated for non-linear characteristics of the receiver.

3. A method according to Claim 2 wherein the second gain level is less than the first gain level.

4. A method according to Claim 2 wherein the first and second signal strength measurements are logarithmic received signal strength indications.

5. A method according to Claim 2 further comprising the step preceding the obtaining a first signal strength measurement step of:

   determining an expected strength of a next signal strength measurement of the received signal; and
   wherein said step of obtaining a second signal strength measurement of the received signal is not executed and the compensated signal strength measurement is the first signal strength measurement if the expected signal strength is less than a predetermined criteria.

6. A method according to Claim 1 wherein the step of generating the compensated signal strength measurement of the received signal based on the signal strength compensating factor comprises the step of summing the signal strength compensating factor and the first signal strength measurement to provide the compensated signal strength measurement.

7. A method according to Claim 6 wherein the received signal is a radio communications signal from a communication network and further comprising the step following the summing step of:

   transmitting the compensated signal strength measurement to the network for use in mobile assisted handover.

8. A method according to Claim 1 wherein the step of generating the compensated signal strength measurement of the received signal based on the signal strength compensating factor comprises the steps of:

   obtaining a previously determined compensation factor associated with the second signal strength measurement; and

summing the signal strength compensating factor, the previously determined compensation factor associated with the second signal strength measurement and the first signal strength measurement to provide the compensated signal strength measurement.

9. A method according to Claim 8 wherein the received signal is a radio communications signal from a communication network and further comprising the steps following the summing step of:

averaging the compensated signal strength measurement with an earlier compensated signal strength measurement to provide an averaged signal strength measurement; and
transmitting the averaged signal strength measurement to the network for use in mobile assisted handover.

10. The method of Claim 8 further comprising the steps following said summing step of:

obtaining a previously determined compensation factor associated with the second signal strength measurement; and
adjusting the previously determined compensation factor associated with the second signal strength measurement based on the signal strength compensating factor to provide an updated compensation factor associated with the second signal strength measurement.

11. A system for measuring a strength of a received signal including a receiver capable of operating at a first gain and a second gain wherein the system further includes:

a received signal strength indication generating circuit (34) electrically connected to the receiver (10) which provides a signal strength indication corresponding to a strength of a signal received by the receiver (10); and
a compensated signal strength measurement generating circuit (24) which generates a compensated signal strength measurement of the received signal based on a first signal strength measurement at the first gain and a second signal strength measurement at the second gain, **characterized in that** the compensated signal strength measurement generating circuit comprises:

means (24) for determining an expected difference between a first signal strength measurement at the first gain and a second signal strength measurement at the second gain;
means (24) for generating an actual difference between the first signal strength measurement and the second signal strength measurement;
means (24) for comparing the actual difference to the expected difference to provide a signal strength compensating factor; and
means (24) for generating the compensated signal strength measurement of the received signal based on the signal strength compensating factor.

12. A system according to Claim 11 further comprising:

means (24) for causing the receiver (10) to operate at one of the first gain or the second gain.

13. A system according to Claim 11 wherein the compensated signal strength measurement generating circuit (24) compensates for non-linear characteristics of the receiver.

14. A system according to Claim 13 wherein the signal strength indication is a logarithmic received signal strength indication.

15. A system according to Claim 13 further comprising means for determining an expected signal strength of a next signal strength measurement of the received signal.

16. A system according to Claim 11 wherein the means for generating a compensated signal strength measurement based on the signal strength compensating factor comprises means for summing the signal strength compensating factor and the first signal strength measurement to provide the compensated signal strength measurement.

17. A system according to Claim 11 wherein the received signal is a radio communications signal from a communication network and further comprising:

means (12) for transmitting the compensated signal strength measurement to the network for use in mobile assisted handover.

18. A system according to Claim 11 wherein the means for generating a compensated signal strength measurement based on the signal strength compensating factor comprises:

means (24) for obtaining a previously determined compensation factor associated with the second signal strength measurement; and
means (24) for summing the signal strength compensating factor, the

-previously determined compensation factor associated with the second signal strength measurement and the first signal strength measurement to provide the compensated signal strength measurement.

19. A system according to Claim 18 wherein the received signal is a radio communications signal from a communication network and further comprising:

means (24) for averaging the compensated signal strength measurement with an earlier compensated signal strength measurement to provide an averaged signal strength measurement; and
means (12) for transmitting the averaged signal strength measurement to the network for use in mobile assisted handover.

20. A system according to Claim 18 further comprising:

memory means for storing a previously determined compensation factor associated with the second signal strength measurement; and
means (24) for adjusting the previously determined compensation factor associated with the second signal strength measurement based on the signal strength compensating factor and for storing the adjusted previously determined compensation factor associated with the second signal strength measurement in the memory means.

Patentansprüche

1. Verfahren zum Messen der Stärke eines empfangenen Signals einschließlich des Schrittes des Erhaltens eines ersten Signalstärkemesswerts des empfangenen Signals von einem Empfänger und des Erhaltens eines zweiten Signalstärkemesswerts des empfangenen Signals von dem Empfänger, wobei

der Empfänger (10) auf einen ersten Verstärkungspegel eingestellt ist zum Erhalten des ersten Signalstärkemesswerts und auf einen zweiten Verstärkungspegel eingestellt ist zum Erhalten des zweiten Signalstärkemesswerts ***gekennzeichnet durch*** das weitere Umfassen der Schritte:

Bestimmen einer erwarteten Differenz zwischen dem ersten Signalstärkemesswert und dem zweiten Signalstärkemesswert basierend auf dem ersten Verstärkungspegel und dem zweiten Verstärkungspegel;

Generieren der tatsächlichen Differenz zwischen dem ersten Signalstärkemesswert und dem zweiten Signalstärkemesswert;

Vergleichen der tatsächlichen Differenz mit der erwarteten Differenz zum Bereitstellen eines Signalstärkekompensationsfaktors; und

Generieren eines kompensierten Signalstärkemesswerts des empfangenen Signals basierend auf dem Signalstärkekompensationsfaktor.

2. Verfahren nach Anspruch 1, wobei der kompensierte Signalstärkemesswert kompensiert ist bezüglich nichtlinearer Charakteristika des Empfängers.

3. Verfahren nach Anspruch 2, wobei der zweite Verstärkungspegel geringer ist als der erste Verstärkungspegel.

4. Verfahren nach Anspruch 2, wobei der erste und zweite Signalstärkemesswert logarithmisch erhaltene Signalstärkenangaben sind.

5. Verfahren nach Anspruch 2, außerdem vor dem Schritt des Erhaltens eines ersten Signalstärkemesswerts den Schritt umfassend:

Bestimmen einer erwarteten Stärke eines nächsten Signalstarkemesswerts des empfangenen Signals;

wobei der Schritt des Erhaltens eines zweiten Signalstärkemesswerts des empfangenen Signals nicht ausgeführt wird und der kompensierte Signalstärkemesswert der erste Signalstärkemesswert ist, wenn der erwartete Signalstärkemesswert geringer ist als ein vorbestimmtes Kriterium.

6. Verfahren nach Anspruch 1, wobei der Schritt des Generierens des kompensierten Signalstärkemesswerts des Empfangssignals basierend auf dem Signalstärkekompensationsfaktor den Schritt des Summierens des Signalstärkekompensationsfaktors und des ersten Signalstärkemesswerts umfasst zum Breitstellen ces kompensierten Signalstärkemesswerts.

7. Verfahren nach Anspruch 6, wobei das empfangene Signal ein Funkkommunikationssignal von einem Kommunikationsnetz ist und außerdem den dem Summierungsschritt folgenden Schriet umfasst:

Übertragen des kompensierten Signalstärke-

messwerts zu dem Netz zur Verwendung bei mobilendgeräte-unterstützter Gesprächsumschaltung

8. Verfahren nach Anspruch 1, wobei der Schritt des Generierens des kompensierten Signalstärkemesswerts des empfangenen Signals basierend auf dem Signalstärkekompensationsfaktor die Schritte umfasst:

   Erhalten eines zuvor bestimmten Kompensationsfaktors. der den zweiten Signalstärkemesswert zugeordnet ist; und

   Summieren des Signalstärkekompensationsfaktors, des vorbestimmten Kompensationsfaktors, der dem zweiten Signalstärkemesswert zugeordnet ist, und des ersten Signalstärkemesswertes zum Erhalten des kompensierten Signalstärkemesswertes.

9. Verfahren nach Anspruch 8, wobei das empfangen Signal ein Funkkommunikationssignal von einem Kommunikationsnetz ist, außerdem die folgenden Schritte umfassend, folgend auf den Summationsschritt:

   Mitteln des kompensierten Signalstärkemesswertes mit einem früheren kompensierten Signalstärkemesswert zum Erhalten eines gemittelten Signalstärkemesswertes; und

   Übertragen des gemittelten Signalstärkemesswertes zu dem Netz zur Verwendung in mobilendgeräte-unterstützter Gesprächsumschaltung.

10. Verfahren nach Anspruch 8, außerdem auf den Summationsschritt folgend die Schritte umfassend:

   Erhalten eines zuvor bestimmten Kompensationsfaktors, der dem zweiten Signalstärkemesswert zugeordnet ist; und

   Anpassen des zuvor bestimmten Kompensationsfaktors, der dem zweiten Signalstärkemesswert zugeordnet ist basierend auf dem Signalstärkekompensationsfaktor zum Bereitstellen eines aktualisierten Kompensationsfaktors, der dem zweiten Signalstärkemesswert zugeordnet ist.

11. System zum Messen einer Stärke eines empfangenen Signals einschließlich eines Empfängers, der imstande ist, bei einem ersten Verstärkungsfaktor und einem zweiten Verstärkungsfaktor betrieben zu werden, wobei das System außerdem einschließt:

   eine elektrisch mit dem Empfänger (10) verbundene Empfangssignalanzeigegenerierschaltung (34), die eine Signalstärkeanzeige bereitstellt, die einer Stärke eines von dem Empfänger (10) empfangenen Signals entspricht; und

   eine Generierschaltung (24) eines kompensierten Signalstärkemesswertes, die einen kompensierten Signalstärkemesswert des empfangenen Signals basierend auf einem ersten Signalstärkemesswert bei einer ersten Verstärkung und einen zweiten Signalstärkemesswert bei einer zweiten Verstärkung generiert,

   dadurch gekennzeichnet, dass

   die Generierschaltung eines kompensierten Signalstärkemesswertes umfasst:

   eine Vorrichtung (24). zum Bestimmen einer erwarteten Differenz zwischen einem ersten Signalstärkemesswert bei einer ersten Verstärkung und einem zweiten Signalstarkemesswert bei einer zweien Verstärkung;

   eine Vorrichtung (24) zum Generieren einer tatsächlichen Differenz zwischen dem ersten Signalstärkemesswert und dem zweiten Signalstärkemesswert;

   eine Verrichtung (24) zum Vergleichen der tatsächlichen Differenz mit der erwarteten Differenz zum Bereitstellen eines Signalstärkekompensationsfaktors, und

   eine Vorrichtung (24) zum Generieren des kompensierten Signalstärkemesswertes des empfangenen Signals basierend auf dem Signalstärkekompensationsfaktor.

12. System nach Anspruch 11, außerdem umfassend:

   eine Vorrichtung (24) zum Veranlassen des Empfängers (10), bei einem von den ersten und zweiten Verstärkungsfaktoren betrieben zu werden.

13. System nach Anspruch 11, wobei die Generierschaltung (24) des kompensierten Signalstärkemesswertes bezüglich nicht linearer Charakteristika des Verstärker kompensiert.

14. System nach Anspruch 13, wobei die Signalstärkeanzeige eine logarithmische Anzeige einer empfangenen Signalstärke ist.

15. System nach Anspruch 13, außerdem eine Vorrich-

tung umfassend zum Bestimmen einer erwarteten Signalstärke eines nächsten Signalstärkemesswert des empfangenen Signals.

16. System nach Anspruch 11, wobei die Vorrichtung zum Generieren eines kompensierten Signalstärkemesswertes basierend auf dem Signalstärkekompensationsfaktor eine Vorrichtung umfasst zum Summieren des Signalstärkekompensationsfaktors und dem ersten Signalstärkemesswerts zum Bereitstellen des kompensierten Signalstärkemesswertes.

17. System nach Anspruch 11, wobei das empfangene Signal ein Funkkommunikationssignal von einem Kommunikationsnetz ist und außerdem umfasst:

eine Vorrichtung (12) zum Senden des Signalstärkemesswertes zu dem Netz zur Verwendung in einer mobilendgeräte-unterstützten Gesprächsumschaltung.

18. System nach Anspruch 11, wobei die Vorrichtung zum Generieren des kompensierten Signalstärkemesswertes basierend auf dem Signalstärkekompensationsfaktor umfasst:

eine Vorrichtung (24) zum Erhalten eines zuvor bestimmten Kompensationsfaktors, der dem zweiten Signalstärkemesswert zugeordnet ist; und

eine Vorrichtung zum Summieren des Signalstärkekompensationsfaktors, des zuvor bestimmten Kompensationsfaktors, der dem zweiten Signalstärkemesswert zugeordnet ist und des ersten Signalstärkemesswertes zum Bereitstellen des kompensierten Signalstärkemesswertes.

19. System nach Anspruch 18, wobei das empfangene Signal ein Funkkommunikacionssignal von einem Kommunikationsnetz ist, und außerdem umfassend:

eine Vorrichtung (24) zum Mitteln des kompensierten Signalstärkemesswertes mit einem früher kompensierten Signalstärkemesswert zum Bereitstellen eines gemittelten Signalstärkemesswertes; und
eine Vorrichtung (12) zum Senden des gemittelten Signalstärkemesswertes zu dem Netz zur Verwendung in einer mobilendgeräte-unterstützten Gesprächsumschaltung.

20. System nach Anspruch 18, außerdem umfassend:

eine Speichervorrichtung zum Speichern eines zuvor bestimmten Kompensationsfaktors, der dem zweiten Signalstärkemesswert zugeordnet ist; und

eine Vorrichtung (24) zum Anpassen des zuvor bestimmten Kompensationsfaktors, der dem zweiten Signalstärkemesswert zugeordnet ist basierend auf dem Signalstärkekompensationsfaktor und zum Speichern des eingestellten zuvor bestimmten Kompensationsfaktors, der dem zweiten Signalstärkemesswert zugeordnet ist in der Speichervorrichtung.

Revendications

1. Procédé pour mesurer le niveau d'un signal reçu comprenant les étapes consistant à obtenir d'un récepteur une première mesure de niveau du signal reçu et à obtenir du récepteur une seconde mesure du niveau du signal reçu, dans lequel

le récepteur (10) est réglé à un premier niveau de gain pour obtenir la première mesure de niveau du signal et il est réglé à un second niveau de gain pour obtenir la seconde mesure de niveau du signal, **caractérisé en ce qu'**il comprend en outre les étapes dans lesquelles :

on détermine une différence prévue entre la première mesure de niveau du signal et la seconde mesure de niveau du signal sur la base du premier niveau de gain et du second niveau de gain ;
on génère la différence réelle entre la première mesure de niveau du signal et la seconde mesure de niveau du signal ;
on compare la différence réelle à la différence prévue pour produire un facteur de compensation de niveau du signal ; et
on génère une mesure du niveau compensé du signal reçu sur la base du facteur de compensation du niveau du signal.

2. Procédé selon la revendication 1, dans lequel des caractéristiques non linéaires du récepteur sont compensées dans la mesure du niveau compensé du signal.

3. Procédé selon la revendication 2, dans lequel le second niveau de gain est inférieur au premier niveau de gain.

4. Procédé selon la revendication 2, dans lequel les première et seconde mesures de niveau du signal sont des indications logarithmiques du niveau du signal reçu.

5. Procédé selon la revendication 2, comprenant en outre l'étape précédant l'étape d'obtention d'une première mesure de niveau du signal dans laquelle :

on détermine un niveau prévu d'une mesure de niveau du signal suivant du signal reçu ; et
dans lequel ladite étape d'obtention d'une seconde mesure de niveau du signal reçu n'est pas exécutée et la mesure du niveau compensé du signal est la première mesure du niveau du signal si le niveau du signal prévu est inférieur à un critère prédéterminé.

6. Procédé selon la revendication 1, dans lequel l'étape de génération de la mesure du niveau compensé du signal reçu sur la base du facteur de compensation du niveau du signal comprend l'étape de sommation du facteur de compensation du niveau du signal et de la première mesure du niveau du signal pour produire la mesure du niveau compensé du signal.

7. Procédé selon la revendication 6, dans lequel le signal reçu est un signal de radiocommunications provenant d'un réseau de communications et comprenant en outre l'étape, suivant l'étape de sommation, dans laquelle :

on transmet la mesure du niveau compensé du signal au réseau pour l'utiliser dans un transfert assisté du service mobile.

8. Procédé selon la revendication 1, dans lequel l'étape de génération de la mesure du niveau compensé du signal reçu sur la base du facteur de compensation du niveau du signal comprend les étapes dans lesquelles :

on obtient un facteur de compensation déterminé précédemment, associé à la seconde mesure du niveau du signal ; et
on effectue la sommation du facteur de compensation du niveau du signal, du facteur de compensation déterminé précédemment et associé à la seconde mesure du niveau du signal et de la première mesure du niveau du signal pour produire la mesure du niveau compensé du signal.

9. Procédé selon la revendication 8, dans lequel le signal reçu est un signal de radiocommunications provenant d'un réseau de communications comprenant en outre les étapes, suivant l'étape de sommation, consistant :

à établir une moyenne de la mesure du niveau compensé du signal avec une mesure du niveau compensé précédente du signal pour produire une mesure moyenne du niveau du signal ; et
on transmet la mesure moyenne du niveau du signal au réseau pour une utilisation dans un transfert assisté du service mobile.

10. Procédé selon la revendication 8, comprenant en outre les étapes suivant ladite étape de sommation, dans lesquelles :

on obtient un facteur de compensation déterminé précédemment, associé à la seconde mesure du niveau du signal ; et
on ajuste le facteur de compensation déterminé précédemment, associé à la seconde mesure du niveau du signal, sur la base du facteur de compensation du niveau du signal pour produire un facteur de compensation mis à jour associé à la seconde mesure du niveau du signal.

11. Système pour mesurer le niveau d'un signal reçu comprenant un récepteur pouvant fonctionner à un premier gain et à un second gain, dans lequel le système comprend en outre :

un circuit (34) de génération d'indication du niveau d'un signal reçu connecté électriquement au récepteur (10) qui produit une indication du niveau du signal correspondant à un niveau d'un signal reçu par le récepteur (10) ; et
un circuit (24) de génération de mesure du niveau compensé du signal qui génère une mesure du niveau compensé du signal reçu sur la base d'une première mesure du niveau du signal au premier gain et d'une seconde mesure du niveau du signal au second gain, **caractérisé en ce que** le circuit de génération d'une mesure du niveau compensé du signal comporte :

un moyen (24) destiné à déterminer une différence prévue entre une première mesure du niveau du signal au premier gain et une seconde mesure du niveau du signal au second gain ;
un moyen (24) destiné à générer une différence réelle entre la première mesure du niveau du signal et la seconde mesure du niveau du signal ;
un moyen (24) destiné à comparer la différence réelle à la différence prévue pour produire un facteur de compensation du niveau du signal ; et
un moyen (24) destiné à générer la mesure du niveau compensé du signal reçu sur la base du facteur de compensation du niveau du signal.

12. Système selon la revendication 11, comportant en outre :

un moyen (24) destiné à faire fonctionner le récepteur (10) à l'un du premier gain ou du second gain.

13. Système selon la revendication 11, dans lequel le circuit (24) de génération de mesure du niveau compensé du signal compense des caractéristiques non linéaires du récepteur.

14. Système selon la revendication 13, dans lequel l'indication du niveau du signal est une indication logarithmique du niveau du signal reçu.

15. Système selon la revendication 13, comportant en outre un moyen destiné à déterminer un niveau de signal prévu d'une mesure suivante de niveau du signal reçu.

16. Système selon la revendication 11, dans lequel le moyen destiné à générer une mesure du niveau compensé du signal sur la base du facteur de compensateur du niveau du signal comprend un moyen destiné à effectuer la sommation du facteur de compensation du niveau du signal et de la première mesure du niveau du signal pour produire la mesure du niveau compensé du signal.

17. Système selon la revendication 11, dans lequel le signal reçu est un signal de radiocommunications provenant d'un réseau de communications et comportant en outre :

un moyen (12) destiné à transmettre la mesure du niveau compensé du signal au réseau pour une utilisation dans un transfert assisté dans le service mobile.

18. Système selon la revendication 11, dans lequel le moyen destiné à générer une mesure du niveau compensé du signal sur la base du facteur de compensation du niveau du signal comporte :

un moyen (24) destiné à obtenir un facteur de compensation déterminé précédemment, associé à la seconde mesure du niveau du signal ; et
un moyen (24) destiné à effectuer la sommation du facteur de compensation du niveau du signal, du facteur de compensation déterminé précédemment et associé à la seconde mesure du niveau du signal et de la première mesure du niveau du signal pour produire la mesure du niveau compensé du signal.

19. Système selon la revendication 18, dans lequel le signal reçu est un signal de radiocommunications provenant d'un réseau de communications et comportant en outre :

un moyen (24) destiné à établir la moyenne de la mesure du niveau compensé du signal avec une mesure précédente du niveau compensé du signal pour produire une mesure moyenne du niveau du signal ; et
un moyen (12) destiné à transmettre la mesure moyenne du niveau du signal au réseau pour une utilisation dans un transfert assisté dans le service mobile.

20. Système selon la revendication 18, comportant en outre :

un moyen à mémoire destiné à stocker un facteur de compensation déterminé précédemment associé à la seconde mesure du niveau du signal ; et
un moyen (24) destiné à ajuster le facteur de compensation déterminé précédemment et associé à la seconde mesure du niveau du signal sur la base du facteur de compensation du niveau du signal et à stocker le facteur de compensation ajusté, déterminé précédemment, associé à la seconde mesure du niveau du signal dans le moyen à mémoire.

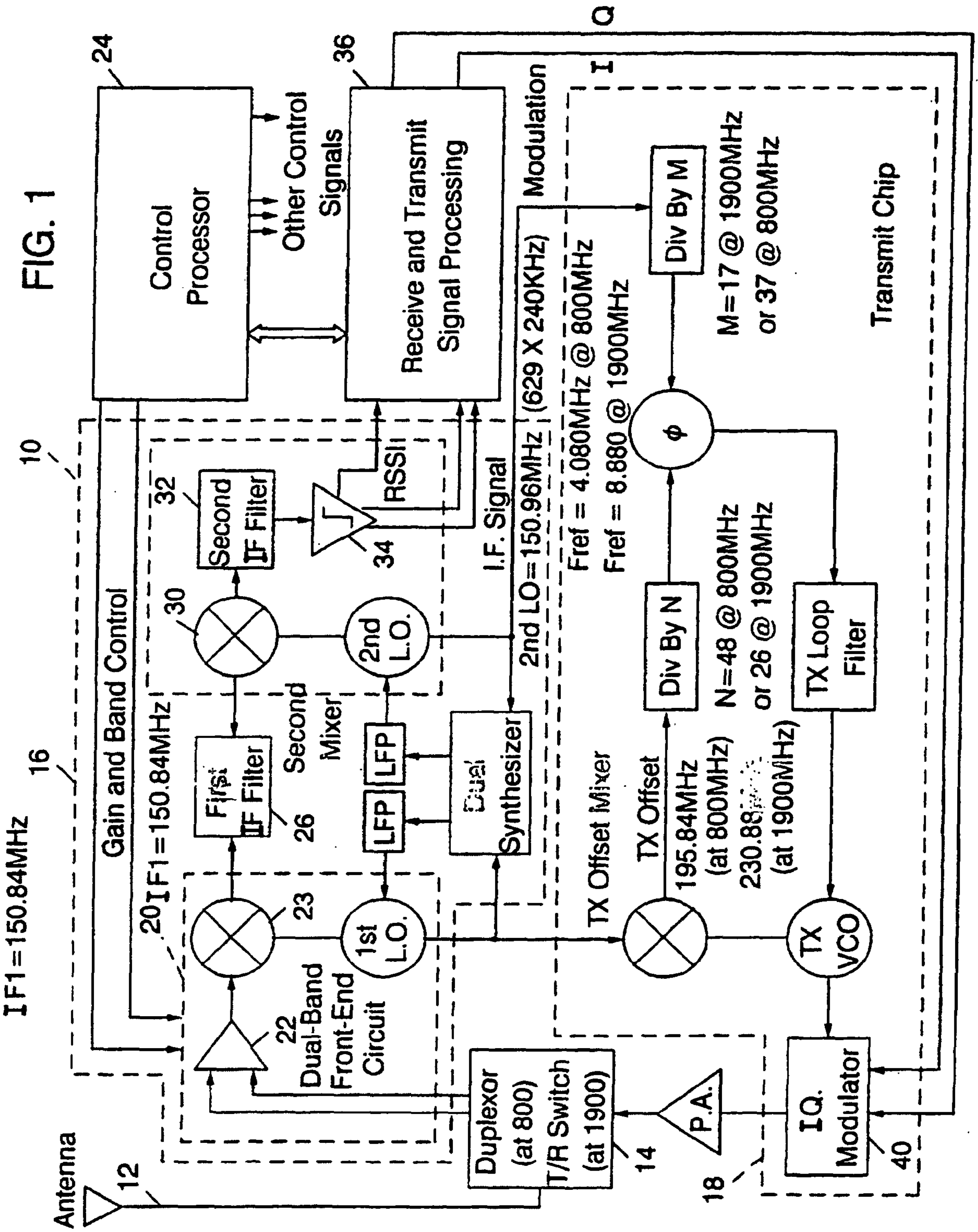

Control Processor
Other Control Signals
Receive and Transmit Signal Processing
24
36
Modulation
Q
I
10
16
IF1=150.84MHz
Gain and Band Control
IF1=150.84MHz
20
First IF Filter
26
Second Mixer
30
Second IF Filter
32
34
RSSI
I.F. Signal
2nd LO=150.96MHz
(629 X 240KHz)
2nd L.O.
LFP
LFP
Dual Synthesizer
1st L.O.
23
22
Dual-Band Front-End Circuit
Fref = 4.080MHz @ 800MHz
Fref = 8.880 @ 1900MHz
Div By M
M=17 @ 1900MHz
or 37 @ 800MHz
Transmit Chip
Div By N
N=48 @ 800MHz
or 26 @ 1900MHz
TX Loop Filter
TX Offset Mixer
TX Offset
195.84MHz
(at 800MHz)
230.88
(at 1900MHz)
TX VCO
IQ. Modulator
40
P.A.
18
Duplexor (at 800)
T/R Switch (at 1900)
14
Antenna
12

FIG. 1

FIG. 2

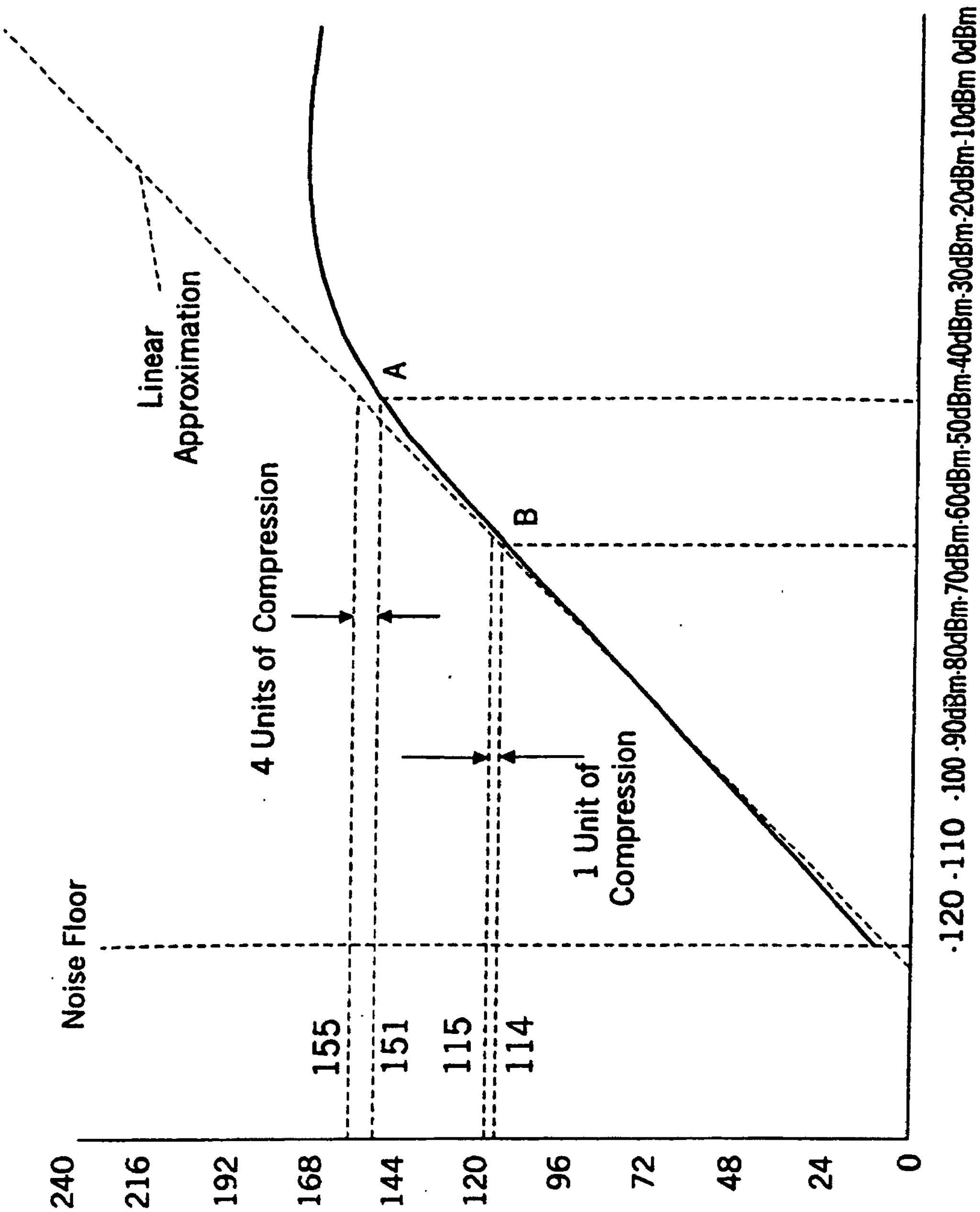

Noise Floor
Linear Approximation
4 Units of Compression
1 Unit of Compression
A
B
155
151
115
114
240
216
192
168
144
120
96
72
48
24
0
-120 -110 -100 -90dBm -80dBm -70dBm -60dBm -50dBm -40dBm -30dBm -20dBm -10dBm 0dBm

FIG. 3

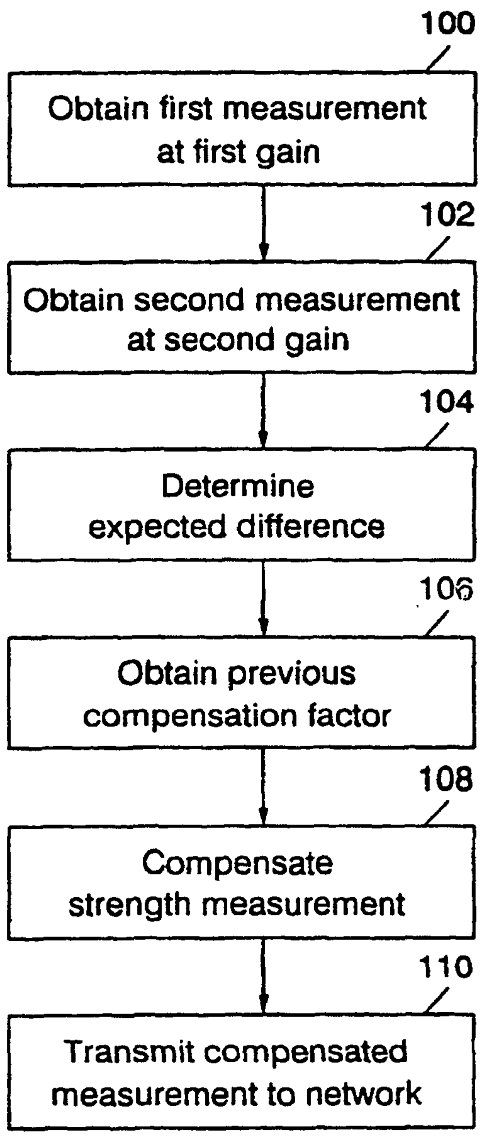
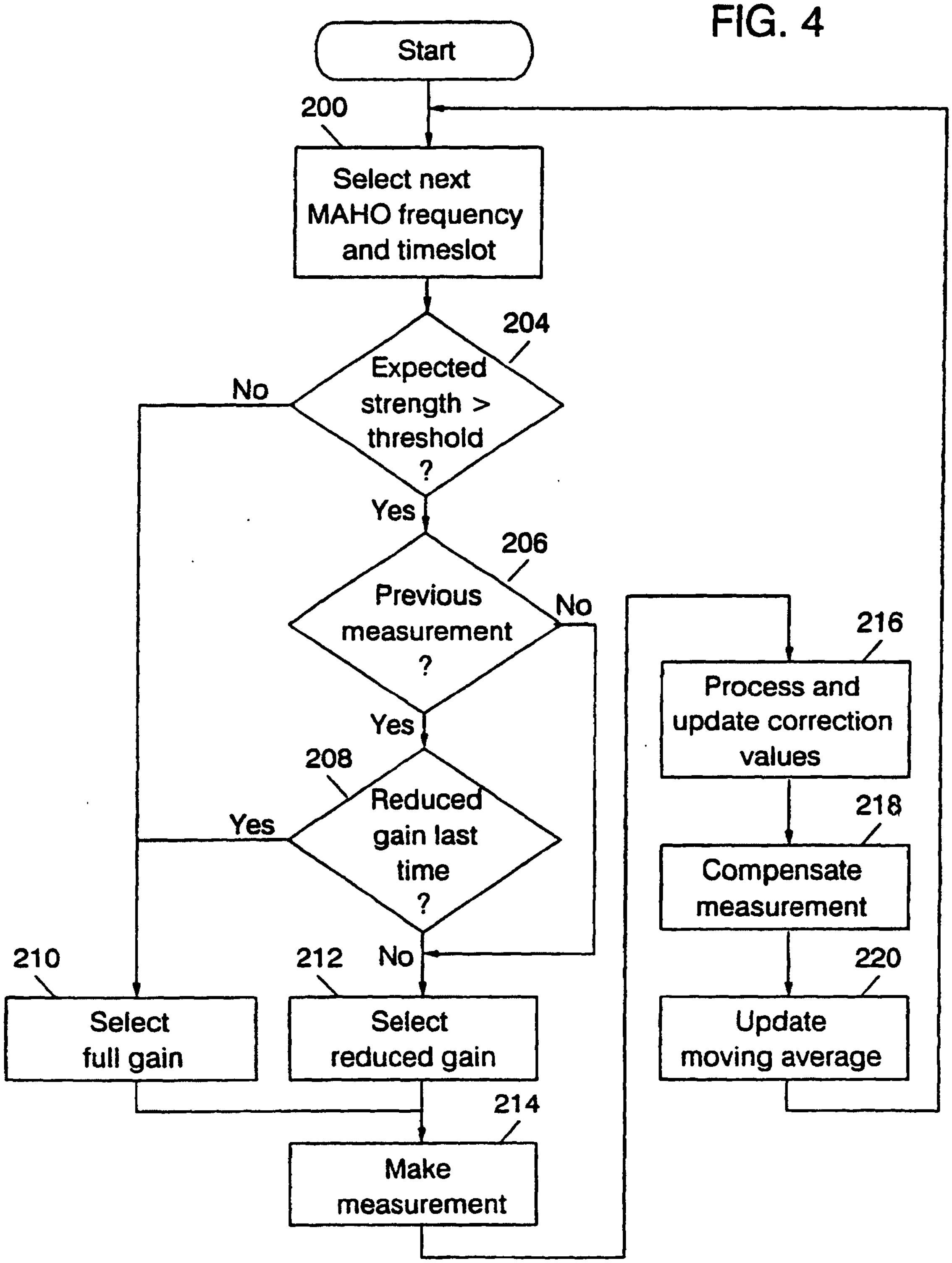

100
Obtain first measurement at first gain
102
Obtain second measurement at second gain
104
Determine expected difference
106
Obtain previous compensation factor
108
Compensate strength measurement
110
Transmit compensated measurement to network

FIG. 4


Start
200
Select next MAHO frequency and timeslot
204
Expected strength > threshold ?
No
Yes
206
Previous measurement ?
No
Yes
208
Reduced gain last time ?
Yes
No
210
Select full gain
212
Select reduced gain
214
Make measurement
216
Process and update correction values
218
Compensate measurement
220
Update moving average